In order to overcome this problem as much as possible, the number of the layers constituting the GMR film may be increased. One example of such GMR film constitution known in the art is a dual-spin valve film (or a symmetry spin valve, hereinafter referred to as D-SV film) in which the pinned magnetic layer is of a two-layered film composed of upper and lower layers and the upper and lower layers are separated by a free layer existing therebetween. This will be helpful in solving the problem, but at least at present could not solve all problems with practicable SV films. For example, in the D-SV film where the free layer is subbed with a nonmagnetic spacer layer, it is difficult to make the free layer have completely satisfactory soft magnetic characteristics characteristics with respect to, for example, the anisotropy field Hk and the level of magnetostriction λ. In addition, where the two upper and lower pinned magnetic layers are used, it is desirable that the two antiferromagnetic films for pinning the magnetization of those two layers have the same blocking temperature. In fact, however, it is difficult to make the lower antiferromagnetic film, which is positioned in the lower side, and the upper antiferromagnetic film, which is positioned in the upper side via a nonmagnetic spacer layer and a free layer, have the same characteristics. Therefore, from the viewpoint of the MR ratio, the D-SV film is preferred, but from the viewpoint of practical applications, it still has

many problems to be solved.

Given that situation, improving the characteristics of the popular SV film having one antiferromagnetic film is being much investigated. One means for the improvement is to incorporate mirror reflectivity into the film. This is to dispose a reflective film on one or both sides of the basic unit of the GMR film of magnetic layer/nonmagnetic spacer layer/magnetic layer, so that electrons are elastically reflected on the reflective film to thereby prolong the mean free path of electrons in the basic unit of the GMR film.

On the upper and lower layers of the basic unit of the conventional GMR film, electrons are scattered non-elastically. In that unit, therefore, electrons could not move to the length of the mean free path intrinsic to them, and they could not enjoy the spin-dependent scattering over the thickness of the basic unit of the GMR film. As a result, the MR ratio in the film could not be increased to a desired degree. Contrary to this, if the GMR structure has upper and lower layers with ideal surface reflectivity, the basic unit of the GMR film could be apparently equivalent to the constitution of an infinite artificial lattice film, in which electrons could scatter spin-dependently to the length comparable to their mean free path. As a result, the MR ratio in this GMR constitution could increase. The reflective films to be disposed over the upper and lower magnetic layer on the

nonmagnetic spacer layer may be or even may not be spin-dependent ones. Even the latter spin-independent reflective films could fully exhibit the intended effect.

The effect applies not only to ordinary SV film structures but also to D-SV film structures. However, the reflective films would be ineffective in artificial lattice films which naturally comprises a numerous and unlimited number of layers and in which electrons are naturally scattered in a spin-dependent manner to the length of their intrinsic mean free path. The specular reflection effect is greater in SV film structures comprising a small number of constituent layers.

Some SV films have heretofore been proposed, which positively incorporate the specular reflection noted above. The following are examples of those SV films.

(c) Si substrate/5 nm NiO/2.5 nm Co/1.8 nm Cu/4 nm Co/1.8 nm Cu/2.5 nm Co/50 nm NiO,

(d) Si substrate/50 nm NiO/2.5 nm Co/2 nm Cu/3 nm Co/0.4 nm Au (Ref.; J. R. Jody et al., IEEE Mag. 33, No. 5, 3580 (1997)),

(e) MgO substrate/10 nm Pt/5 nm Cu/5 nm NiFe/2.8 nm Cu/5 nm Co/1.2 nm Cu/3 nm Ag (Ref.; Y. Kawabu et al., Summary of Reports in Spring Meeting in 1997, p. 142, by the Japan Metal Society),

(f) Si substrate/200 nm Si_3N_4/20 nm Bi_2O_3/4 nm Au/4 nm NiFe/3.5 nm Cu/4 nm CoFe (Ref.; D. Wang et al., IEEE Mag. 32, No. 5, 4278 (1996)).